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Tuesday 31 January 2012 – Morning

GCSE GATEWAY SCIENCE
ADDITIONAL SCIENCE B

B624/02 Unit 2 Modules B4 C4 P4 (Higher Tier)

B620780112

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: 1 hour

B 6 2 4 0 2

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- A list of physics equations is printed on page two.
- The Periodic Table is printed on the back page.
- The total number of marks for this paper is **60**.
- This document consists of **24** pages. Any blank pages are indicated.

EQUATIONS

$$\text{speed} = \frac{\text{distance}}{\text{time taken}}$$

$$\text{acceleration} = \frac{\text{change in speed}}{\text{time taken}}$$

$$\text{force} = \text{mass} \times \text{acceleration}$$

$$\text{work done} = \text{force} \times \text{distance}$$

$$\text{power} = \frac{\text{work done}}{\text{time}}$$

$$\text{kinetic energy} = \frac{1}{2}mv^2$$

$$\text{potential energy} = mgh$$

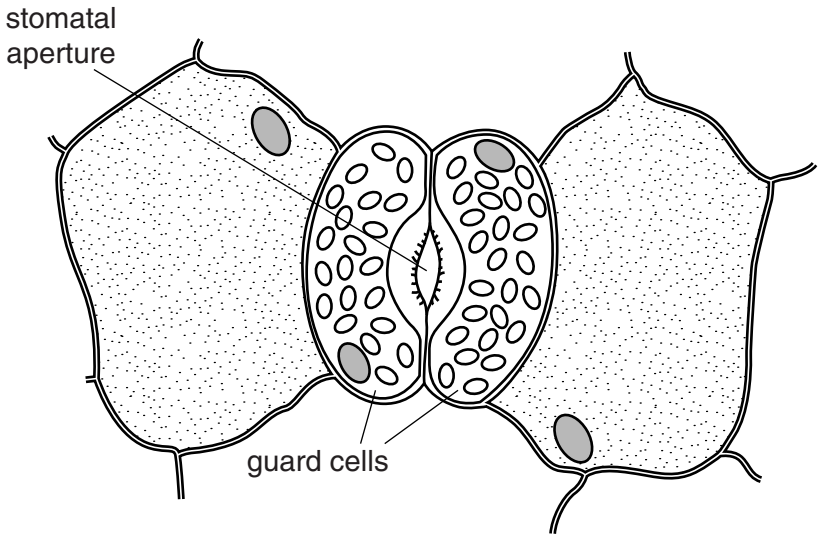
$$\text{weight} = \text{mass} \times \text{gravitational field strength}$$

$$\text{resistance} = \frac{\text{voltage}}{\text{current}}$$

Answer **all** the questions.

Section A – Module B4

1 Look at the diagram of cells found in a plant leaf.



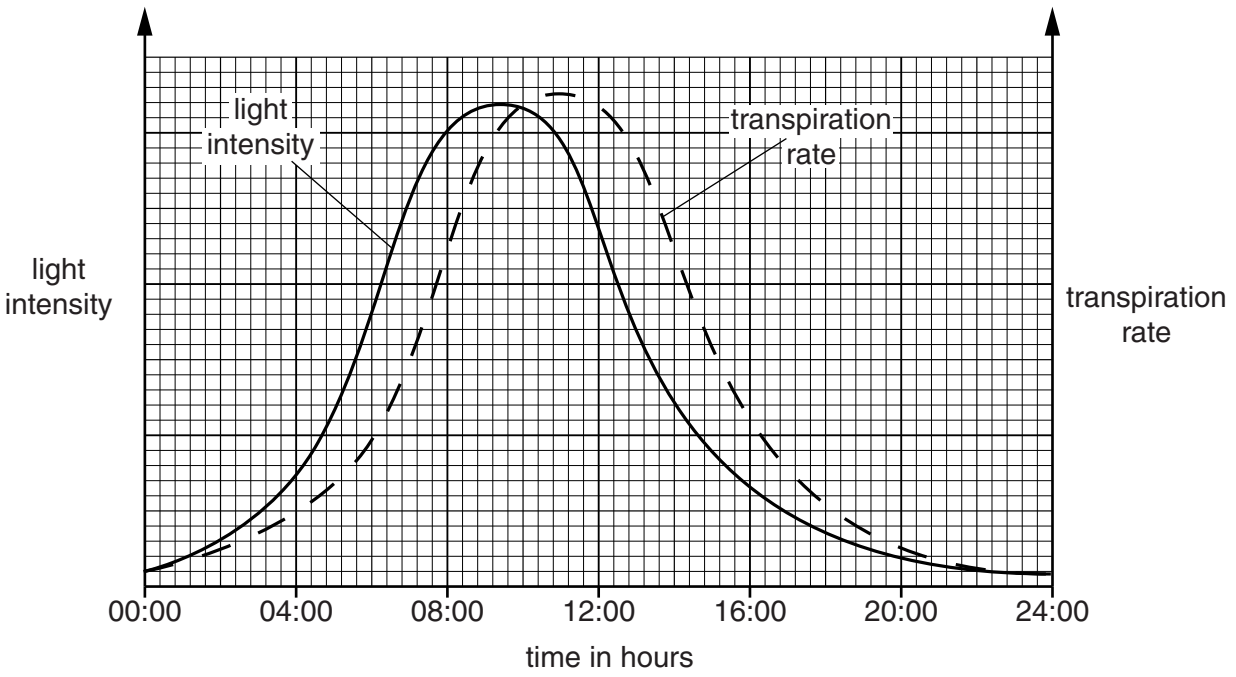
(a) (i) The stomatal aperture is a hole in the leaf.

Why are stomata important for photosynthesis?

..... **[1]**

(ii) Stomata help with the movement of water through the plant by allowing transpiration.

Look at the graph.



Describe in detail how light intensity affects the rate of transpiration.

.....

..... **[1]**

(iii) Tea plants are adapted to live in hot climates.

tea plants

The stomatal apertures of tea plants open mainly at night.

Explain how the stomatal aperture is opened in plants.

.....

.....

..... **[2]**

(iv) The stomatal apertures do **not** fully open during the day.

Suggest why this is an advantage to the tea plants.

..... **[1]**

(b) Transpiration moves water containing **phosphates** from the roots to the rest of the plant.

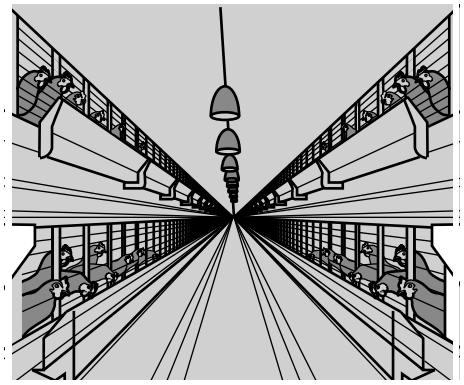
Explain why plants need phosphates.

.....

..... **[2]**

[Total: 7]

2 Look at the picture. It shows intensive farming of chickens.



(a) What is intensive farming?

.....

..... **[1]**

(b) Look at the food chain.

It shows the biomass at each stage.

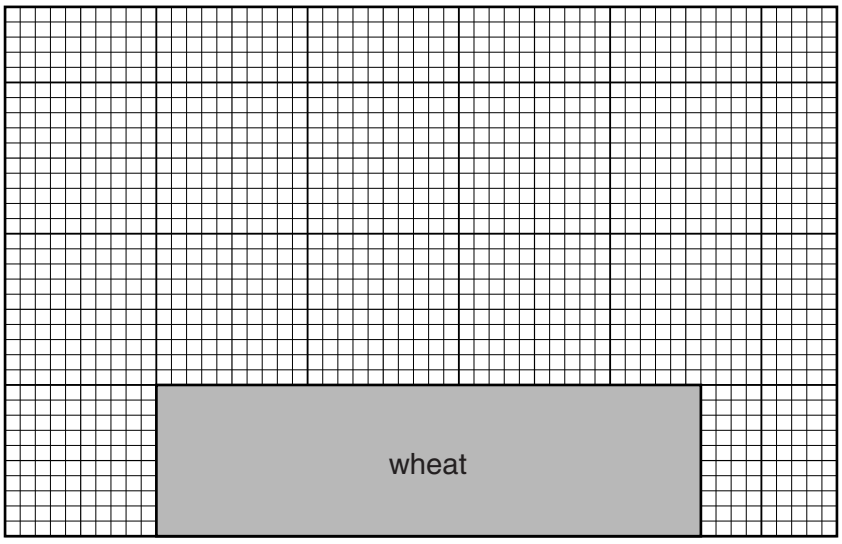
	wheat	⟶ **chickens**	⟶ **humans**
biomass in kg	**360**	**120**	**60**

A pyramid of biomass can be drawn to describe this food chain.

Finish the pyramid of biomass to include the chickens and the humans.

Make sure the bars are drawn **to scale** and **labelled**.

The bar for wheat has been drawn for you.



[2]

(c) Food chains are usually very short in length.

Explain why.

.....

.....

..... **[2]**

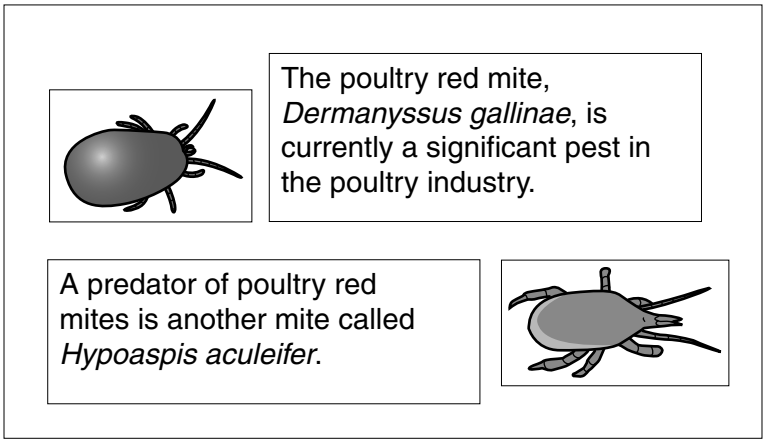
(d) Decomposers recycle nitrogen from organisms in food chains.

Decomposing bacteria convert protein and urea into ammonia.

Write down the name of the **type** of bacteria that converts ammonia into nitrates.

..... **[1]**

(e) Read the information.



The poultry red mite can be controlled using chemicals.

It can also be controlled using *Hypoaspis aculeifer*.

Write down **one** advantage of using *Hypoaspis aculeifer*.

.....

..... **[1]**

[Total: 7]

3 This question is about decay and food preservation.

Apricots are fruits.

Apricots decay when bacteria and fungi feed on them.

The table shows the growth of bacteria at 25°C.

time in hours	number of bacteria in thousands per cm^3
5	15
10	30
15	60
20	.....

(a) Predict the number of bacteria in thousands per cm^3 after 20 hours.

Write your answer in the table. **[1]**

(b) (i) Apricots can be preserved by drying them.

Explain how this reduces the rate of decay.

.....

..... **[1]**

(ii) Apricots can also be preserved in jams.

Jams contain concentrated sugar solution.

Bacteria contain dilute sugar solution.

This slows down the decay of apricots by bacteria.

Which two statements best explain how this happens?

Put ticks (✓) in the boxes next to the **two** correct statements.

Water moves from a low concentration to a high concentration of water.	☐
Water moves out of the concentrated sugar solution into the bacteria.	☐
Water moves from a high concentration to a low concentration of water.	☐
Water moves out of the bacteria into the concentrated sugar solution.	☐
There is no net movement of water between the bacteria and the concentrated sugar solution.	☐

[2]

(c) Decay releases minerals into the soil.

Plants absorb minerals into root hairs by active transport.

Plants absorb water into root hairs by osmosis.

Explain **two** ways active transport is different from osmosis.

1. .....

.....

2. .....

..... **[2]**

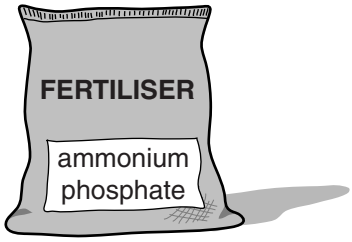
[Total: 6]

Section B – Module C4

4 Colin grows vegetables in his garden.

He uses fertiliser to increase his crop yield.

The fertiliser contains ammonium phosphate.



(a) Ammonium phosphate is made by reacting phosphoric acid with an alkali.

Write down the name of this **alkali**.

..... **[1]**

(b) What is the **total** number of **atoms** in the formula $(NH_4)_3PO_4$?

..... **[1]**

(c) Calculate the percentage by mass of **nitrogen** in ammonium phosphate, $(NH_4)_3PO_4$.

The relative atomic mass, A_r:

H = 1, N = 14, O = 16, P = 31.

.....

.....

.....

.....

percentage by mass = ... % **[2]**

[Total: 4]

5 A scientist in America is researching a plant called wormwood.

He has extracted a chemical from wormwood which may protect humans from malaria.

(a) Describe one way chemicals can be extracted from plants.

Your answer should include

- what is done to the plant
- the name of a method used to purify the chemical.

.....

.....

.....

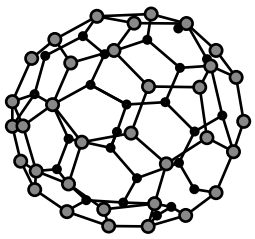
..... **[2]**

(b) The scientist needs to find a way of delivering the chemical to treat the patient.

He needs a drug delivery system inside the patient's body.

He reads that fullerenes can be used to deliver drugs.

Look at the diagram of buckminsterfullerene.



buckminsterfullerene

Explain how buckminsterfullerene can be used to deliver drugs.

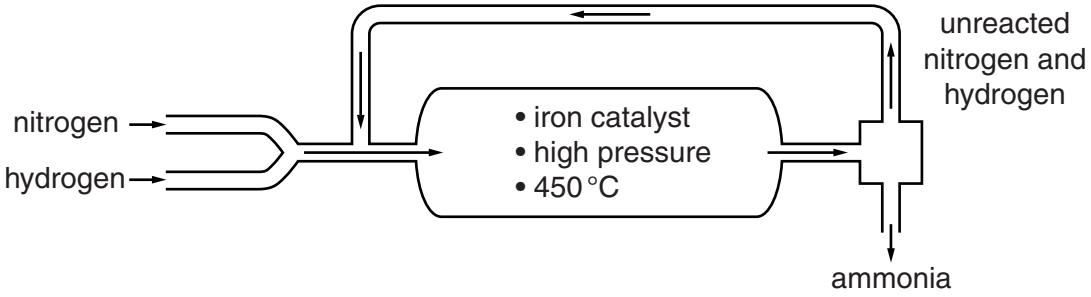
.....

..... **[1]**

[Total: 3]

6 **(a)** Ammonia is made in the Haber process.

The diagram shows how ammonia is made in the Haber process.



Write down the **word** equation for the reaction in the Haber process.

..... **[1]**

(b) The table shows the percentage yield of ammonia made at different temperatures and pressures.

pressure in atmospheres	percentage yield at 350°C	percentage yield at 450°C	percentage yield at 550°C
100	16	12	6
200	30	22	12
300	40	28	16
400	50	36	20
500	56	42	24

(i) Which temperature and pressure give the **highest yield** of ammonia?

temperature ..... pressure ..... **[1]**

(ii) How does the **percentage yield** of ammonia change as the **temperature increases**?

..... **[1]**

(c) The optimum conditions used to make ammonia are

- an iron catalyst
- a pressure of 200 atmospheres
- a temperature of 450°C.

Explain why these conditions are used.

Use ideas about percentage yield and rate of reaction.

.....

.....

.....

.....

.....

..... **[3]**

[Total: 6]

7 Look at the picture of a polluted river.

(a) This river flows into a reservoir.

The water must be purified before being used as drinking water.

The drinking water may still contain very small amounts of pollutants.

One of these pollutants is nitrate ions.

Write down how the nitrate ions could have got into the water.

.....

..... **[1]**

(b) Cheryl analyses a sample of water to find the mass of chloride ions present.

(i) She mixes the water with silver nitrate solution.

Sodium chloride, NaC*l*, reacts with silver nitrate, $AgNO_3$, to make sodium nitrate, $NaNO_3$, and a precipitate of silver chloride, AgC*l*.

Write down the **balanced symbol** equation for this reaction.

..... **[1]**

(ii) Cheryl predicts she should make 0.72 g of silver chloride.

She actually makes 0.24 g of silver chloride.

Calculate her percentage yield.

.....

.....

.....

percentage yield = ...% **[2]**

[Total: 4]

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PLEASE DO NOT WRITE ON THIS PAGE

8 This question is about reactions between acids and bases.

(a) Bill adds some sodium hydroxide solution to dilute hydrochloric acid in a flask.

The pH of the solution in the flask increases as the sodium hydroxide is added.

Explain why the pH increases.

.....

..... **[1]**

(b) Sodium hydroxide contains hydroxide ions.

Hydrochloric acid contains hydrogen ions.

Write down the **balanced ionic** equation for the reaction between these two ions.

..... **[2]**

[Total: 3]

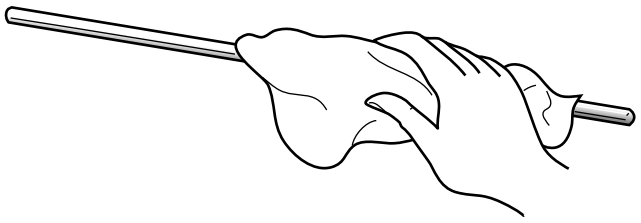
Section C – Module P4

9 This question is about static electricity.

(a) Amy rubs an insulating rod with a duster.

The rod becomes **positively charged**.

Look at the picture.



Which sentence correctly describes what happens?

A Neutrons move from the duster to the rod.

B Electrons move from the rod to the duster.

C Protons move from the rod to the duster.

D Protons move from the duster to the rod.

Choose from **A** **B** **C** **D**

answer ..... **[1]**

(b) Television engineers sometimes work in areas where there are large amounts of electrostatic charge. They are in danger of getting an electric shock.

Explain how they can reduce the chance of getting an electric shock.

.....

.....

..... **[2]**

(c) Dermot's factory gives out black smoke from its chimney.

Static electricity can be useful for removing the particles from smoke in chimneys.

Explain how.

In your answer write about

- what needs to be added inside the chimney
- how the system removes particles from the smoke.

.....

.....

.....

.....

..... **[3]**

[Total: 6]

10 This question is about electricity.

(a) Ben has an electric toaster.

There are three wires connected to the plug.

The earth wire is needed for safety reasons.

How does the earth wire make the toaster safer to use?

.....

..... **[1]**

(b) Ben's toaster is connected to the 230 V mains.

When the toaster is switched on, the current in the heating element is 4.6 A.

Calculate the resistance of the heating element.

The equations on page 2 may help you.

.....

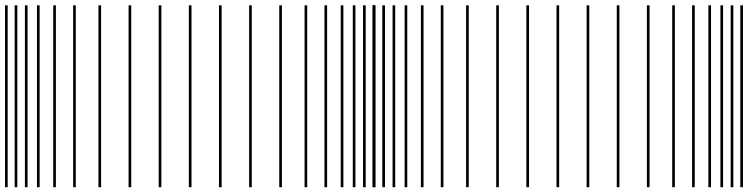
.....

.....

answer ..... ohms **[2]**

[Total: 3]

11 Look at the diagram of a longitudinal wave.



(a) Write the letter **C** on the diagram to show the centre of a compression and the letter **R** to show the centre of a rarefaction. **[1]**

(b) What is meant by the **frequency** of the wave?

.....

..... **[1]**

[Total: 2]

12 Alpha, beta and gamma are three types of radioactive emission.

(a) Radioactive sources are used as tracers in the human body.

Look at the table of properties for different emitters.

type of emitter	typical range in air in cm	typical range in human soft tissue in cm
alpha	3.7	0.0005
beta	90	1.2
gamma	70 000	100

Alpha emitters are **not** used as tracers in the human body, but gamma emitters are.

Explain why. Use the information in the table.

.....

.....

.....

..... **[2]**

(b) X-rays and gamma rays are both electromagnetic waves, with similar wavelengths.

They are **produced** in very different ways.

(i) Finish the sentence.

Gamma rays are emitted from the ..... of ..... atoms. **[1]**

(ii) How are **X-rays** produced?

.....

.....

..... **[1]**

(iii) X-rays are now used to treat cancer more than gamma rays.

Suggest a reason why.

.....

.....

..... **[1]**

[Total: 5]

13 Radioisotopes are used in industry. They are radioactive elements.

(a) An industrial process uses radioactive iron.

The iron is put into a nuclear reactor.

When it is removed, the iron is radioactive.

What happens to the iron in the reactor to make it radioactive?

.....

..... **[1]**

(b) Industry uses radioisotopes as tracers.

Write down one example of how a tracer is used in **industry**.

.....

..... **[1]**

(c) There is also radiation that occurs naturally in the environment.

It is called background radiation.

(i) Write down **one** example of a **major** natural source of background radiation.

.....

..... **[1]**

(ii) Some background radiation comes from industry.

Write down one **other** example of a **major** man-made source of background radiation.

.....

..... **[1]**

[Total: 4]

END OF QUESTION PAPER

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

**** The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.***

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.